

Claims

1. A method for controlling a pump station, a pump included in the pump station transferring liquid from or into a tank and said pump being controlled by an electric drive comprising a frequency converter, the method comprising
 - 5 - measuring the surface level of a liquid in the tank by means of a sensor (205),
 - controlling the activation of the pump on the basis of the measured surface level (206-213),
- 10 **characterised in that the method comprises**
 - selecting a first value of the liquid surface level,
 - selecting as the value of the first rotation speed of the pump substantially the value at which the amount of transferred liquid relative to the consumed energy is 15 at maximum and
 - monitoring the moment when the surface level reaches said first value of the liquid surface level from a predetermined direction (206) and controlling as a consequence of this detection the pump rotation speed to said first value (204, 207) of the rotation speed,
- 20 - said monitoring of the surface level and control of the rotation speed being performed in a frequency converter.
- 25 2. A method as defined in claim 1, **characterised in that a tank is filled by means of a pump at a pump station, said predetermined direction being from the top towards the bottom.**
- 30 3. A method as defined in claim 1, **characterised in that a tank is emptied by means of a pump at a pump station, said predetermined direction being from the bottom towards the top.**
- 35 4. A method as defined in claim 1, **characterised in selecting a second value (202) of the rotation speed of the pump and in monitoring the moment at which the liquid surface level reaches the following second value (208) of the surface level from said predetermined direction, and as a consequence of this detection, the rotation speed of the pump is controlled to a second value (204, 209) of the rotation speed.**

5. A method as defined in claim 4, **characterised** in that said second value of the rotation speed is the maximum rotation speed.
6. A method as defined in claim 1, **characterised** in that at least two pumps (M1, M2, M3) are controlled at the pump station so that the pumps are in operating turns (a-b, c-d, e-f, g-h) alternately.
7. A method as defined in claim 1, **characterised** in that at least two pumps (M1, M2, M3) are controlled at the pump station and a third value of the rotation speed is selected, and while the first pump is operating, the moment is monitored at which the liquid surface level reaches a third value (B) of the surface level from said predetermined direction, and as a consequence of this detection, the second pump (M2) is also activated.
- 15 8. A method as defined in claim 1, **characterised** in that said predetermined at least one value of the surface level and at least one value of the rotation speed are stored in the frequency converter of the pump station.
9. A method as defined in claim 1, **characterised** in that said measurement of the surface level is performed in the frequency converter on the basis of a signal received from the surface level sensor.
- 20 10. A method as defined in claim 1, **characterised** in that an alarm signal is received from the alarm sensor of the pump and the pump is controlled on the basis of the received alarm signal.
11. A method as defined in claim 1, **characterised** in that an alarm function is performed when the liquid surface level exceeds a selected alarm limit value.
- 30 12. A method as defined in any of the preceding claims, **characterised** in that at least one selected value of the liquid surface level is varied in order to avoid that solid constituents in the liquid gather on the wall of the tank at the selected surface level.
- 35 13. A frequency converter (420) for the electric drive of a pump station, the pump station comprising a liquid tank (460), a pump (440) and an electric drive (401,

420, 430) actuating the pump, **characterised** in that the frequency converter (420) comprises

- means (422) for storing a first value of the liquid surface level,
- means (422) for storing a first value of the rotation speed of the pump,
- means (423) for measuring the liquid surface level on the basis of a signal received from the sensor (452),
- means (421) for detecting the moment the liquid surface level reaches said first value of the liquid surface level from a predetermined direction and means (420) for controlling the rotation speed of the pump to said first value of the rotation speed as a consequence of said detection so that said first value of the rotation speed is substantially the value at which the amount of transferred liquid relative to the consumed energy is at maximum.

15 14. A frequency converter as defined in claim 13, **characterised** in that the pump of the pump station has been disposed to fill the tank, said predetermined direction being from the top to the bottom.

20 15. A frequency converter as defined in claim 13, **characterised** in that the pump of the pump station has been disposed to empty the tank, said predetermined direction being from the bottom to the top.

25 16. A frequency converter as defined in claim 13, **characterised** in comprising means (422) for storing the second value of the rotation speed and means (421) for monitoring the moment the liquid surface level reaches the following second value of the surface level from said predetermined direction, and means (420) for controlling the rotation speed of the pump to a second value of the rotation speed as a consequence of this detection.

30 17. A frequency converter as defined in claim 16, **characterised** in that said second value of the rotation speed is the maximum rotation speed.

35 18. A frequency converter as defined in claim 13, **characterised** in that the pump station comprises at least two pumps, the frequency converter being disposed to control the pump so as to set it in operating turn alternately with two or more other pumps.

19. A frequency converter as defined in claim 18, **characterised** in comprising means for transmitting control data to the frequency converter of a second pump and/or for receiving control data from the frequency converter of a second pump for controlling the operating turns of the pumps.

5

20. A frequency converter as defined in claim 18, **characterised** in comprising means for transmitting surface level data to the frequency converter of a second pump and/or for receiving surface level data from the frequency converter of a second pump.

10

21. A frequency converter as defined in claim 13, **characterised** in comprising a memory unit (422) for storage of said predetermined at least one value of the surface level and of at least one value of the rotation speed and also for storage of a program controlling the electric drive.

15

22. A frequency converter as defined in claim 13, **characterised** in comprising a measurement unit (423) for receiving a signal from the surface level sensor (452) and for determining the surface level on the basis of the received signal.

20

23. A frequency converter as defined in claim 13, **characterised** in comprising a terminal for connecting the surface level sensor.

24. A frequency converter as defined in claim 13, **characterised** in comprising a processor (421) for controlling the electric drive on the basis of the surface level data and on the basis of the program that controls the processor.

25

25. A frequency converter as defined in claim 13, **characterised** in comprising means for receiving an alarm signal from the alarm sensor of the pump and means for controlling the pump on the basis of the received alarm signal.

30

26. A frequency converter as defined in claim 13, **characterised** in comprising means for performing an alarm function if the liquid surface level exceeds a predetermined alarm limit value or if an alarm signal has been received from the alarm sensor of the pump.

35

27. A frequency converter as defined in claim 13, **characterised** in comprising software stored in the frequency converter for controlling the frequency converter to perform at least one of the following functions:

- 5 - measurement of the liquid surface level on the basis of a signal from the sensor and control of the rotation speed of the pump on the basis of the liquid surface level,
- variation of at least one selected value of the liquid surface level in order to avoid that solid ingredients in the liquid gather on the wall of the tank at the selected 10 surface level;
- coordination of the control of at least two pumps so that the pumps are activated in turns,
- performing an alarm function when the liquid surface level exceeds a predetermined alarm limit value, and
- 15 - monitoring the alarm signals received from the alarm sensors of the pump and controlling the pump on the basis of the alarm signals.